

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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1. AGENCY USE ONLY <i>(Leave blank)</i>	2. REPORT DATE 10 Oct 97	3. REPORT TYPE AND DATES COVERED Final (13 Aug 97 - 10 Oct 97)
4. TITLE AND SUBTITLE Combat Service Support (CSS) Vector-in-Commander (VIC) Analysis in Support of Force XXI Analyses Division Design Analysis -- Phase III CSS Analysis of VIC Dynamic Gaming Strike Division Interim Design (South West Asia 2.0)		5. FUNDING NUMBERS
6. AUTHOR(S) Peter Barnes, John Steffey		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) US Army TRADOC Analysis Center - Fort Lee ATTN: ATRC-L Fort Lee, VA 23801-1511		8. PERFORMING ORGANIZATION REPORT NUMBER Technical Report TRAC TR 1096
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) HQ TRAC Fort Leavenworth, KS 66027-2345		10. SPONSORING / MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES Provided supporting documentation for the Force XXI Division Design Analysis Phase III Division Combat Service Support Analysis.		
12a. DISTRIBUTION / AVAILABILITY STATEMENT Distribution is unlimited; approved for public release.		
19980113 208		
13. ABSTRACT <i>(Maximum 200 words)</i> In 1995, TRADOC initiated the analytical process described in the March 1995 draft Joint Venture (JV) Campaign Plan. The resulting analyses provide the basis for redesigning today's Warfighting Army for the 21st century. The combat unit elements, combat service elements, and the combat service support elements needed to be analyzed individually to determine whether or not each of these sections would be able to effectively perform under the given scenario conditions. TRAC-Lee was tasked to analyze the CSS capabilities of the three (3) division designs (Conservative Heavy, Strike, Brigadier) for DDA Phase III. The three division designs were dynamically gamed using the Vector-in-Commander model in the LANTICA III, Northeast Asia 2.0, and Southwest Asia 4.2 scenarios. The CSS elements represented in VIC were analyzed by TRAC-Lee with the primary focus of the analysis was on the maintenance and supply operations and how the CSS units functioned for the given scenario.		
This analysis concluded that the CSS structure in the Strike Division can support the division during a 24-hour battle such as the one portrayed in the South West Asia 2.0 scenario. There were a few problem areas in the CSS elements that were focused on in this analysis. The automotive mechanics at the DSB and the CSB(DS) could not maintain all of the damaged vehicles sent to their maintenance facilities for repair; moreover, some of the artillery units used all of their ammunition reserves and were not resupplied in a timely manner.		
14. SUBJECT TERMS Maintenance Analysis, Supply Analysis		15. NUMBER OF PAGES 38
16. PRICE CODE		
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED
20. LIMITATION OF ABSTRACT UL		

GIST

STUDY TITLE: Combat Service Support (CSS) Vector-in-Commander (VIC) Analysis in Support of Force XXI Analyses Division Design Analysis – Phase III CSS Analysis of VIC Dynamic Gaming Strike Division Interim Design (South West Asia 4.2)

PURPOSE: The purpose of this analysis was to produce quantitative analysis of the Strike Division Interim Design's combat service support (CSS) structure which was dynamically gamed in the South West Asia 4.2 scenario with the VIC model. The focus of the analysis was on the maintenance and supply operations and how the CSS units functioned for the given scenario.

MAIN ASSUMPTIONS: The principal assumptions of this study include: (a) all repair parts were available upon request, (b) Echelons-Above-Division (EAD) were fully resourced, and (c) CSS enablers and other technological equipment are present.

PRINCIPAL FINDINGS: The CSS structure in the Strike Division could support the division during the 24-hour battle in the SWA 4.2 scenario with a couple of exceptions. The automotive mechanics in the supporting the DSB and CSB(DS) could not handle the maintenance workload produced during the scenario. Several artillery units expended all of their ammunition resources at some time during the scenario and could not be resupplied in a timely manner.

IMPACT: This report suggests that the CSS structure in the Strike Division is sufficient to sustain the division in a scenario such as the one portrayed in SWA 4.2.

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1. TITLE OF STUDY: Combat Service Support (CSS) Vector-in-Commander (VIC) Analysis in Support of Force XXI Analyses Division Design Analysis – Phase III CSS Analysis of VIC Dynamic Gaming Strike Division Interim Design (South West Asia 4.2)

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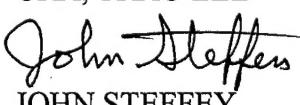
5. UNLIMITED DISTRIBUTION; APPROVED FOR PUBLIC RELEASE PER DIRECTOR, TRADOC ANALYSIS CENTER, FORT LEE, (TRAC-LEE).

Combat Service Support (CSS) Vector-in-Commander
(VIC) Analysis in Support of Force XXI Analyses
Division Design Analysis -- Phase III CSS Analysis of VIC
Dynamic Gaming Strike Division Interim Design
(South West Asia 4.2).
Technical Report



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Combat Service Support (CSS)
Vector-in-Commander (VIC) Analysis
in Support of Force XXI Analyses

Division Design Analysis -- Phase III
CSS Analysis of VIC Dynamic Gaming
Strike Division Interim Design (Southwest Asia 4.2)
13Aug97 VIC Analysis Data

1. General.

a. The Commanding General (CG) Training and Doctrine Command (TRADOC) tasked the TRADOC Analysis Center (TRAC) to conduct an analysis of the Combat Service Support (CSS) Division redesign concept. TRAC at Fort Lee, Virginia (TRAC-LEE) used Vector-in-Commander (VIC) analysis to provide quantitative analysis of that concept.

b. The dynamic gaming with the VIC model is based on the Southwest Asia 4.2 scenario with a total duration of 24 hours incremented in four hour time periods (TP) and a four (4) hour reorder cycle time between CSS units. The modeled force, the STRIKE Interim Division, consists of two brigades with corps support. Specific descriptions and details for both the scenario and modeled force are provided in the main report.

c. The analysis focuses first on those key maneuver unit resources necessary for a unit to perform its designated mission. The specific resources addressed are weapon system availability and the timely availability of supplies. Secondly, various aspects of the CSS system are examined to isolate bottlenecks or shortages which limit the provision of needed services. And conversely, excesses or under-utilized CSS resources are identified for this scenario.

d. The analysis entails two major areas: maintenance support and supply support. Since the medical support system for the treatment of personnel is very similar in function to that of the maintenance system, medical support is addressed along with maintenance.

e. VIC unit name designators are used in this report for brevity. Appendix A shows the cross reference between actual unit names and VIC unit names.

2. Model Description.

a. The Vector-in-Commander (VIC) model is a two-sided, deterministic simulation of integrated land and air combat. The level of resolution is the maneuver battalion. As a deterministic model, VIC relies upon expected values; weapon systems, transporters, inventories/stockage levels, and consumption can be fractional values. VIC is event stepped for maneuver elements and both time stepped and event stepped for calculation of combat service support (CSS) effects. The combat and combat support (CS) functions in VIC produce a workload for the CSS system. Two key modules within VIC are used to represent the CSS system: Return to Duty (RD - maintenance) and Logistics (LO - supply).

b. The return-to-duty (RD) module operates on equipment and noncrew personnel, both of which are referred to as systems, as well as crews for key combat vehicles.

(1) Workloads. The attrition modules generate combat casualty workload in the form of combat-damaged systems. These quantities are adjusted to factor out catastrophic damage/killed in action (KIA) and abandonments (equipment only) before becoming a workload on the RD system. Reliability failures to equipment and disease and nonbattle injury (DNBI) to personnel are also generated, resulting in their removal from units and their introduction as workload upon the RD system.

(2) Processes. The RD module contains representations of the recovery, evacuation, and repair functions.

(a) Recovery is constrained by the availability of operational recovery vehicles. Recovery operations are represented as a delay time of 57 to 96 minutes which includes round trip travel, hook-up, and drop-off. The recovery time varies from vehicle to vehicle and the primary location of that vehicle.

(b) Evacuation is constrained by the availability of operational evacuation vehicles and dynamic evacuation times that are a function of distance and time on the main supply route (MSR) network.

(c) Repair is constrained by the available strength and type of assigned mechanics or medical personnel. Of course repair throughput is impacted by the 'time to repair' but repair time is determined by design factors and not CSS. A maintenance unit's maintenance man-hours (MMH) is degraded by fifty percent when that unit has to relocate on the battlefield. This degradation is calculated to the nearest quarter of an hour; therefore, a maintenance unit's MMH during a portion of a TP could be degraded while the remaining MMH are unaffected. The degradation of MMH availability is based on the premise that a maintenance facility will have only 50 percent of its assets (to include personnel) fully functioning at any time during a battlefield relocation.

(3) Products. The final product of the RD module is the return of crewed systems to owning units. Intermediate products of the various RD processes include recovered systems, evacuated systems, and repaired systems.

(4) Combat impacts on RD processes. Impacts include attrition of RD assets, productivity degradation due to unit movement, changes in evacuation distances due to unit movements, and changes in evacuation speeds due to congestion of MSR links.

c. The logistics (LO) module provides the support structure to facilitate the resupply of ammunition, fuel, and other supplies to maneuver units and the restocking of these supplies at supply units.

(1) Workloads. The attrition modules dynamically generate the workload for ammunition as units engage in conflict. As units move and change posture they create a workload for fuel. A workload for other supplies is generated by a daily consumption rate, depending upon unit types. When maneuver units deplete their basic loads to specified reorder levels, a requirement for resupply is levied on the CSS system.

(2) Processes. The LO module contains representation of the resupply and move functions. Resupply to maneuver units is constrained by the availability of resupply vehicles, availability of supplies at supply units, load times, and travel time between the unit and its supplier. The availability of supplies at supply points is constrained by transportation, availability of load facilities, and load/unload times. The move function is constrained by the availability of CSS trucks, congestion of the MSRs, and travel times between supply units.

(3) Products. The final product for the resupply and distribution system is the replenishment of expended ammunition, fuel, and other supplies to maneuver units. Intermediate products include the restocking of resupply units and the movement of supplies along the MSRs from higher echelon supply units.

(4) Combat impacts on LO processes. Attrition and movement of supply units as a result of combat effects degrade the ability of these units to perform their resupply function. Resources which can be lost at the supply units include resupply vehicles, stocks, and materiel-handling equipment (MHE). The relocation of supply units results in degradation of their receipt/issue capability during the move. In addition, attrition of resupply vehicles, both at the maneuver unit and along the MSRs, degrades the ability of the CSS system to deliver supplies.

3. Assumptions.

- a. Maintenance characteristics and parameters of all systems remain constant across the scenario.
- b. When damaged weapon systems reach a maintenance facility, the correct tools, parts, and equipment are present at the facility. If the number of mechanics necessary to work on the damaged weapon system is available, they will begin working on the damaged weapon system immediately (i.e., prep time and time spent for damage assessment are not played in the model).
- c. The DNBI rate remains constant across the scenario.
- d. Resupply of all stockage items is available from echelons above corps (EAC).

4. Sufficiency Criteria.

- a. Equipment. Maintain 80 percent availability of systems that have not been destroyed or abandoned. Rationale: Army Regulation (AR) 220-1, Unit Readiness Reporting, defines an equipment availability status of 80-90 percent as category C2 which is fully combat ready with minor risk.
- b. Personnel.
 - (1) Have no weapon systems in awaiting-reissue queue due to nonavailability of crews. Rationale: The availability of weapon systems crews affects the availability criterion for combat systems.
 - (2) Maintain 80 percent personnel strength level for all modeled personnel. Rationale: AR 200-1 defines a personnel strength level of 80-90 percent as category C2 which is combat ready with minor risk.
- c. Supply. Have no zero balance of any supply-class subitem (e.g., 155mm, 120mm, POL). Rationale: The lack of a specific type could adversely affect tactical options.

5. Maintenance Analysis.

- a. The six weapon system categories covered in this analysis are shown in table M-1. The Fixed Wing category was not represented in the CSS system. In addition, medical treatment of personnel and weapon crews are presented as a separate category.

Category	Weapon System
TANK	M1A2
AFV	M2A3/TOW FSV/45MM BSFVE/STINGER M3A3/TOW
ADA	AVENGER
MLRS	MLRSD
CANNON	AFAS-D
HELICOPTERS	AH64D RAH66

Key Weapon Categories
Table M-1

b. The primary maintenance performance measure at the maneuver unit level is availability of unit weapon systems. Availability of unit weapon systems is determined by the current strength of weapon systems at a maneuver unit versus the initial strength less the number of catastrophically killed weapon systems at the same maneuver unit. The number of weapon systems available is a function of many dependent and interdependent factors. These factors can be partitioned into two groups: (1) those factors which render weapon systems inoperable: combat damage and reliability and (2) factors that contribute to the return of repaired systems to combat. When more weapon systems are returned to combat, a larger population is available for combat and reliability failure, which in turn workloads the Return-to-Combat (RTC) support system.

(1) Factors which cause weapon systems to become inoperable are combat damage and reliability failures. Combat damage is a function of the interaction of opposing forces resulting in catastrophic kills and repairable battle damage. The percentage of catastrophic kills versus the percentage of repairables varies by weapon system due to threat weapons and survivability characteristics. Table M-2 shows the percent repairable for each system once combat damaged. The percentages are not measures of overall survivability but are conditional results based on a weapon system first being combat damaged. Overall survivability also involves the likelihood of a weapon system being acquired and then being hit by the enemy. The percentages in table M-2 are, therefore, predicated on the occurrence of these two events.

Category	Weapon System
M1A2	93
M2A3/TOW	83
FSV/45MM	83
BSFVE/STINGER	83
M3A3/TOW	83
AVENGER	69
MLRSD	71
AFAS-D	49
AH64D	41
RAH66	41

Percent Repairable by Weapon
Table M-2

(2) Permanent losses of operational systems can occur in several ways. The most frequent is usually due to catastrophic combat damage. In addition, both types of candidate repairables (combat and reliability) are subject to weapon system abandonment at the maneuver unit or maintenance unit level. Maneuver and maintenance unit abandonment's of weapon systems occur due to immediate war-fight conditions, thus becoming permanent losses like catastrophic kills. Weapon systems can be traveling on an MSR when the scenario ends; thus these weapon systems are not considered part of a combat unit's arsenal. Another key factor which affects availability is the nonavailability of an owning unit. This occurs when a maintenance unit has repaired systems but does not have a maneuver unit in its area of influence with authorization to accept the system. In some cases, such weapons are never reissued during the scenario. Crewed weapon systems' RTC may be delayed because the appropriate number of crew members is not available to operate the weapon system. All five of these factors (catastrophic damage, abandonments, unit non-availability, and weapon systems waiting crews) are independent of the CSS system performance. Table M-3 shows the number of systems for each of these categories at the end of the scenario.

Weapon	# Weapons Waiting Units	# Weapons Waiting Crews	# Weapons Being Reissued	Maneuver Unit Abandonments	Catastrophic Kills	Total
M1A2	0.0	3.3	17.3	4.4	7.9	32.9
M2A3/TOW	0.0	2.9	6.2	1.3	11.6	22.0
FSV/45MM	0.0	4.0	0.3	0.0	6.2	10.5
BSFVE/STINGER	0.0	0.3	0.8	0.0	0.8	1.9
M3A3/TOW	0.0	0.5	0.0	0.2	0.5	1.2
AVENGER	0.0	Not crewed	0.0	0.0	0.8	0.8
MLRSD	0.0	0.0	0.0	0.0	6.5	6.5
AFAS-D	0.0	0.4	0.2	0.0	5.0	5.6
AH64D	0.0	0.0	0.0	0.0	8.6	8.6
RAH66	0.0	0.0	0.0	0.0	1.2	1.2
Total	0.0	11.4	24.0	5.9	49.9	

Weapon System Losses

Table M-3

(3) Reliability failures are based on mean hours between failures (MHBF) for the major subsystems of each weapon. The major subsystems for this study are Automotive, Armament, Helicopter, and Medical. Of course, the subsystems that fail or are damaged vary by weapon systems (e.g., the M1A2 is composed of both subsystems, automotive and armament, while only automotive is represented for the heavy equipment transporter (HET)). Each subsystem is serviced by a different mechanic type. In addition, the MHBF can vary by subsystem for each weapon. Helicopters, for this analysis, are serviced by a single type master mechanic although both automotive and armament failures occur for helicopters. In addition, all wounded/DNBI personnel are treated by a single medical type. The availability and performance of trucks used for resupply is addressed in the supply section of the report.

(4) Factors which influence the RTC of weapon systems are recovery, evacuation, and repair (to include medical treatment of personnel and crews) resources. Each of the CSS resources which performs these services is subject to both combat damage and reliability failure, which determine their availability for weapon system processing and treatment of personnel. Recovery and evacuation are performed on a designated priority basis, while repair and treatment are based on a more complex priority system. Further complicating the impact of repair on weapon system RTC are the repair characteristics of individual weapon systems. These characteristics vary by level of repair (i.e., unit, direct support (DS), general support (GS)), and mean time to repair for each type repair (combat, reliability). These characteristics represent a very complex interrelated system which determines the number of operational weapon systems.

c. Analysis. The maintenance analysis is divided into three sections:

(1) Support Services Sufficiency.

(a) Recovery - Weapons.

1 Recovery operations serviced the recovery workload in a timely manner. "Timely manner" is defined as servicing the recovery workload within two TPs for a given maintenance unit. To meet this criterion the recovery workload at the end of one TP must be serviced in the next time period. The reason for this explanation of "timely manner" is to account for the maximum time of 96 minutes it takes for a recovery vehicle to assist in the recovery of a damaged weapon system or vehicle. If a vehicle requires an assisted recovery during the last half of the current TP, that vehicle would not reach the designated maintenance area until the next TP. The two recovery vehicles modeled are the improved recovery vehicle (M88) and a generic recovery vehicle (HMTWRECKER) which represent all other recovery vehicles which are not M88s. Table M-4 provides an overview of both recovery vehicles' status for the scenario where:

Initial Strength (stgn) is the assigned density at the start of the scenario.

End Strength (stgn) is the number operational at the end of the scenario.

End Availability is the percentage of initial strength available less the number destroyed or abandoned at the end of the scenario.

M88				HMTWRECKER			
Unit ID	Initial Stgn	End Stgn	End Availability	Unit ID	Initial Stgn	End Stgn	End Availability
B000000	27	25.5	94	B000000	20	19.6	98
B10000H	4	3.8	94	B10000H	6	5.9	98
B1000UH	1	0.9	89	B1000DH	2	2.0	98
B1100AR	5	4.9	99	B1000EN	2	2.0	98
B1100H2	4	3.7	93	B1000LH	5	4.9	98
B1110AR	6	3.2	53	B1000UH	4	3.9	98
B1120AR	6	5.5	92	B1100AR	6	6.0	100
B1130MX	6	5.5	92	B1110AR	3	2.6	87
B1140MX	6	5.7	94	B1120AR	3	2.8	94
B1200H2	4	3.6	89	B1130MX	3	2.9	97
B1200MX	5	4.6	92	B1140MX	3	2.9	96
B1210AR	6	5.6	93	B1200MX	6	5.9	98
B1220MX	6	5.6	94	B1210AR	3	2.9	98
B1230MX	6	5.6	94	B1220MX	3	2.9	98
B1250AR	6	5.2	87	B1230MX	3	2.9	98
				B1250AR	3	2.9	97

M88 and HMTWRECKER Ending Abilities

Table M-4

The "end availability" is a reliable indicator of availability and recovery support throughout the scenario. Table M-5 provides the combined recovery operations for all divisional maintenance units by TP.

TP	1	2	3	4	5	6
# RECOV.	96.7	80.7	43.6	31.6	46.7	31.4
WAITING RECOV.	33.3	13.4	8.1	6.9	7.8	7.5

Recovery Operations for All Divisional Maintenance Units

Table M-5

2 Table M-6 lists the recovery workload for all maintenance units by recovery vehicle type.

Maintenance	Recovered by			Maintenance	Recovered by		
Unit	HMTWRECKER	M88	TOTAL	Unit	HMTWRECKER	M88	TOTAL
B000000	94.3	93.0	187.3	B1120AR	7.4	16.0	23.4
B10000H	0.4	12.4	12.8	B1130MX	0.4	15.3	15.7
B1000DH	0.3	0.0	0.3	B1140MX	0.6	3.2	3.8
B1000EN	0.1	0.0	0.1	B1200H2	0.0	3.6	3.6
B1000LH	0.3	0.0	0.3	B1200MX	1.9	4.7	6.6
B1000UH	0.3	0.2	0.5	B1210AR	0.2	2.1	2.3
B1100AR	0.9	11.7	12.6	B1220MX	0.2	9.6	9.8
B1100H2	0.0	2.1	2.1	B1230MX	0.2	2.9	3.1
B1110AR	0.6	23.1	23.7	B1250AR	0.3	22.5	22.8

Recovery Workload (by M88 and HMTWRECKER)

Table M-6

3 Conclusion:

Recovery operations are not a constraint on weapon system RTC.

(b) Recovery - Personnel.

The recovery of injured personnel is implied; therefore, injured personnel do not require a recovery vehicle for transport from the battlefield to a medical facility. This phenomenon negates the possibility of a backlog of injured personnel needing recovery. Hence, personnel RTC will never be impeded by recovery assets.

(c) Evacuation - Weapons.

1 Evacuation support is performed in the scenario by HETs and a generic evacuation vehicle. The purpose of the generic evacuation vehicle is to represent the backhaul capability of other transporters. The analysis focuses on the HETs because they are considered potential constraints on evacuation. All but four of the key weapon systems utilize HETs for evacuation. The exceptions are AH64D, RAH66, AVENGER, and the PATRIOT. Only the performance of HETs is addressed. Weapon system evacuations are performed in a "timely manner" if damaged weapon systems are evacuated to the designated area (division only) within two TPs of the sustained damage.

2 Evacuation in this scenario is supported at the division area (unit B000000) with 24 HETs assigned. Evacuations occur for two reasons:

- designation of maintenance support at higher support levels.
- lengthy clockhour repair times (any vehicle or weapon system that requires more than seven clockhours to repair will be sent to the corps support area (CSB(DS)) so it will not 'tie up' mechanics at the ORG level with maintenance work that requires a considerable amount of time).
- maintenance overflow (maintenance overflow occurs when the number of hours needed to repair awaiting weapon systems exceeds a maintenance man hour threshold set for a maintenance unit).

3 Across the scenario, a maximum of four percent of the corps forward area's HETs were not available at any given TP, all due to RAM damage.

4 There were nine vehicle and weapon system evacuations to the corps forward area which required a HET (refer to table M-7). All nine of these vehicles were AVLs. All of these vehicles and weapon systems were evacuated to the corps forward area in a "timely manner."

TP	1	2	3	4	5	6
# EVACs.	1.0	1.7	1.7	1.5	1.3	1.3
WAITING EVAC.	0.4	0.5	0.5	0.4	0.4	0.3

Evacuation Workload - Division Area

Table M-7

5 Conclusion:

Evacuation is not a constraint on weapon system RTC.

(d) Evacuation - Personnel.

No data was available; this function was not represented in the VIC model.

(e) Repair - ground based weapons.

1 Sufficient repair support is determined by the availability of required mechanic types at the supporting maintenance facility for ORG/DS and GS levels. For the most part, FORCE XXI mechanics in the DISCOM are modular in that they can repair both ORG and DS level damaged vehicles. Table M-8 shows, for assigned ORG/DS level mechanics, the maximum MMH percentage utilized for each of the 20 maintenance facilities across the scenario. When this percentage is 100, sufficient mechanics were not available to service the workload (note shaded cells) at some point during the scenario.

2 There is one exception to the above described 100 percent indicator - maintenance backlog overflow. Resource status is reported only at the end of a TP thus making it possible that 100 percent utilization occurred within the TP but shows less at the end of the TP due to completion of repairs. So the condition can exist where the ending TP utilization is less than 100 percent but within a TP, conditions existed that caused maintenance backlog overflow.

Unit Name	Armament		Automotive		Helicopter		Medical	
	Util. %	Str.	Util. %	Str.	Util. %	Str.	Util. %	Str.
DSB	0	38	100	55	0	8	39	34
B100002	40	12	5	18			41	8
B10000H	90	9	100	15	15	18	21	25
B1000DH	8	1	7	6	23	41	70	3
B1000EN	0	1	31	1			10	8
B1000LH	8	1	9	6	60	21	83	3
B1000UH	0	1	10	6	5	39	100	3
B10DASB	0	2	29	5			100	2
B1100AR	24	32	100	48			38	24
B1100H2	4	8	100	13			55	9
B1110AR	100	20	72	45			61	10
B1120AR	89	20	88	45			65	10
B1130MX	100	20	100	38			31	21
B1140MX	21	20	51	38			34	21
B1200H2	2	8	35	13			62	9
B1200MX	3	32	46	48			58	24
B1210AR	22	20	10	45			49	10
B1220MX	100	20	62	38			36	21
B1230MX	25	20	26	38			34	21
B1250AR	100	20	99	45			99	10

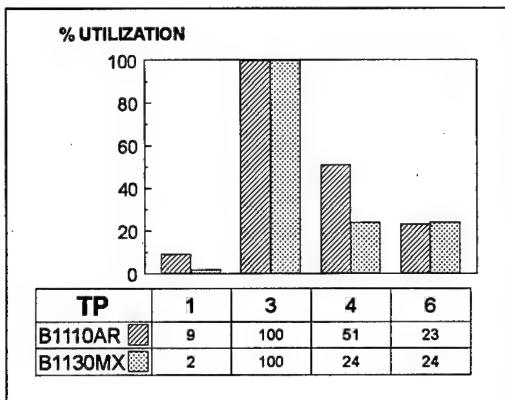
Utilization and Initial Strength by ORG/DS Level Mechanics
Table M-8

3 In general, for those facilities with less than 100% utilization at the end of a TP, sufficient maintenance resources were always available. There were only minor exceptions when very small fractional workloads were evacuated due to backlog status and the MMH utilization was not 100%. Any under-utilized resources are not necessarily "excesses" but are indicators of the magnitude of the workload for this scenario. Force structure implications are not addressed in this report.

4 Figures M-1 through M-4 show the MMH utilization by mechanic type for those maintenance units with 100% utilization.

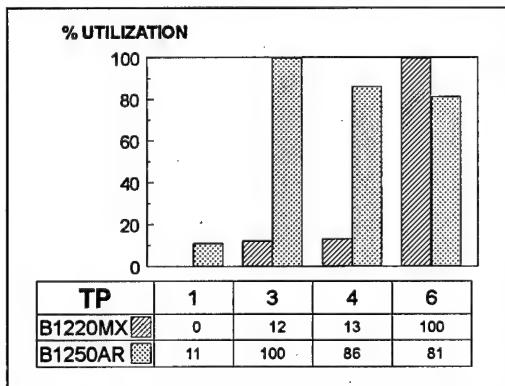
a Four maintenance facilities' ORG/DS level armament mechanics were 100 percent utilized: the 1st and 3rd maneuver battalions' FSCs of the 1st brigade (units B1110AR and B1130MX), the FSC supporting 2nd mechanized infantry battalion of the 2nd

brigade (unit B1220MX), and the 5th maneuver battalion's FSC of the 2nd brigade (unit B1250AR).



ORG/DS Level Armament Mechanic Utilization for the 1st and 3rd maneuver battalions' FSCs of the 1st brigade
Figure M-1

- The utilization of the 1st brigade's 1st and 3rd battalion's FSCs (units B1110AR and B1130MX) can be found in Figure M-1. Both of these FSCs' armament mechanics reached 100 percent utilization during TP 3. The 1st battalion had to have one M1A2 and one M2A3/TOW recovered to the 1st brigade's BSC because of maintenance overflow. This maintenance facility also had one M1A2 and one M2A3/TOW waiting for armament repair at the end of TP 3. The 3rd battalion's FSC recovered two M2A3/TOWs to the BSC on account of maintenance overflow, and this unit had three M2A3/TOWs waiting for armament mechanics to become available at TP 3. By the end of TP 4 the workload at these two FSCs was nearly non-existent.



ORG/DS Level Armament Mechanic Utilization for the FSCs supporting 2nd and 5th maneuver battalions of the 2nd brigade
Figure M-2

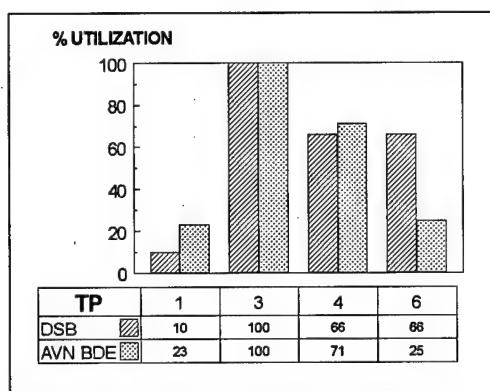
- The armament mechanics in support of the 2nd brigade's 2nd mechanized infantry battalion (unit B1220MX) became fully utilized during TP 6. No vehicles or weapon systems had to be recovered to the 2nd brigade's BSC because of maintenance overflow, but there were two M2A3/TOWs and one M1A2 waiting for armament repair at the end of TP 6. These weapon systems were a result of the number of combat damaged weapon systems recovered to this FSC during TP 5.

- The armament mechanics in support of the 2nd brigade's 5th armored battalion (unit B1250AR) became fully utilized during TP 3. No vehicles or weapon systems had to be recovered to the 2nd brigade's BSC because of maintenance overflow, but there were

two M2A3/TOWs and one M1A2 waiting for armament repair at the end of TP 3. These weapon systems were repaired by the next TP.

b Five maintenance facility's ORG/DS level automotive mechanics were 100 percent utilized: the DSB (unit B000000), the aviation brigade (unit B10000H), the 1st brigade's BSC (unit B1100AR), the 1st brigade's 155SP battalion (unit B1100H2), and the FSC supporting 3rd mechanized infantry battalion of the 1st brigade (unit B1130MX).

- The utilization of the automotive mechanics supporting the DSB and the DASB is listed in Figure M-3.

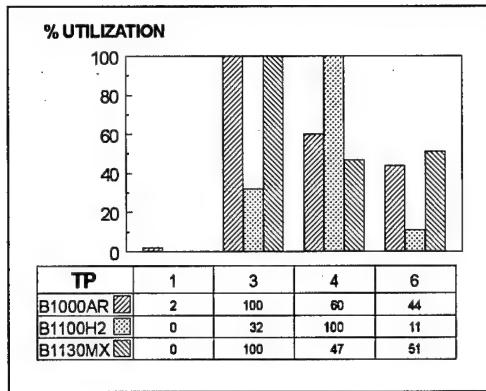


ORG Level Automotive Mechanic Utilization
for the DSB and the Aviation Brigade
Figure M-3

- The automotive mechanics in the DSB became fully utilized during TP 3. No vehicles or weapon systems had to be evacuated to the corps rear because of maintenance overflow. The following vehicles were waiting for automotive repair at the end of TP 3: seven 22-ton cargo trucks, five 5000 gallon fuel tankers, four AVLBS, three PLS ammo trucks, and one 5-ton ammo truck. At the end of the scenario (TP 6), there was still a large workload waiting for automotive mechanics to become available: seven 22-ton cargo trucks, six AVLBS, four 5000 gallon fuel tankers, three PLS ammo trucks, and one 5-ton ammo truck.

- The automotive mechanics at the DASB became fully utilized during TP 3. No vehicles or weapon systems had to be evacuated to the corps area because of maintenance overflow. The following vehicles and weapon systems were waiting for automotive repair at the end of TP 3: four FSV/45MMs, one M1A2, and one ACE. At the end of the scenario (TP 6), all vehicles and weapon systems requiring automotive repair at the DASB were serviced and returned to duty.

- The automotive mechanic utilization for the 1st brigade's BSC (unit B1100AR), 1st brigade's 155SP battalion (unit B1100H2), and the FSC supporting the 3rd mechanized infantry battalion of the 1st brigade (unit B1130MX) is displayed in Figure M-4.



ORG Level Automotive Mechanic Utilization for the 1st Brigade's BSC (unit B1000AR), 1st Brigade's 155SP Battalion (unit B1100H2), and the FSC Supporting 3rd Mechanized Infantry Battalion of the 1st Brigade (unit B1130MX).

Figure M-4

- The automotive mechanics at the 1st brigade's BSC were fully utilized during TP 3. No vehicles or weapon systems had to be evacuated to the CSB(DS) because of maintenance overflow. The following vehicles and weapon systems were waiting for automotive repair at the end of TP 3: two M1A2s, two M88s, two HMMWVs, two 5-ton ammo trucks, one M2A3/TOW and one ACE. During TP 4, as well as, at the end of the scenario (TP 6), the workload waiting for automotive mechanics to become available was negligible.

- The ORG level automotive mechanics at the 1st brigade's 155SP battalion were fully utilized during TP 4. No vehicles or weapon systems had to be evacuated to the CSB(DS) because of maintenance overflow. Very few vehicles and weapon systems had to wait for automotive mechanics to become available during TP 4.

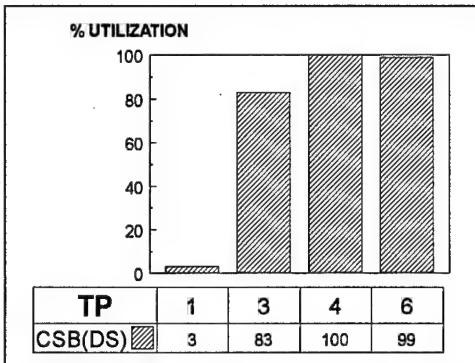
- The automotive mechanics in support of the 1st brigade's 3rd mechanized infantry battalion (unit B1130MX) became fully utilized during TP 3. No vehicles or weapon systems had to be recovered to the 1st brigade's BSC because of maintenance overflow, but there were nine HMMWVs, three 5-ton ammo trucks, and one M2A3/TOW waiting for automotive repair at the end of TP 4. At the end of the scenario TP 6, the workload waiting for automotive mechanics to become available at this FSC was negligible.

c See Table M-9 for the CSB(DS)'s mechanic strengths and utilization.

Unit Name	Armament		Automotive		Helicopter		Medical	
	Util. #	Str.	Util. #	Str.	Util. #	Str.	Util. #	Str.
CSB(DS)	20	51	100	77	35	26	7	150

Utilization and Initial Strength of the CSB(DS) DS Level Mechanics
Table M-9

- The automotive mechanics in the CSB(DS) became fully utilized during TP 4 (see Figure M-5) and nearly reached 100 percent during TP 6. No vehicles or weapon systems had to be evacuated to the corps rear because of maintenance overflow. At the end of TP 4, there were seven M2A3/TOWs, three M88s, two AFAS-Ds, two MLRS, two HETs, one M1A2, one BSFVE/STINGER, and one FARV waiting for automotive mechanics to become available. At the end of the scenario, there was still a build-up of vehicles and weapon systems at this unit: seven M2A3/TOWs, four M88s, two MLRS, two HETs, one M1A2, and one AFAS-D.



DS level Automotive MMH Utilization for the CSB(DS)
Figure M-5

5 Conclusion:

The automotive mechanics at the DSB constrained the above mentioned CSS vehicles from returning to duty. There was an insufficient number of automotive mechanics at the CSB(DS) to handle the workload produced by this scenario.

(f) Repair - helicopters.

Note: The AH64D (Apache) and the RAH66 (Comanche) are the systems represented by the helicopter weapon system category.

1 Sufficient helicopter repair support is determined by the availability of required helicopter mechanics at the supporting maintenance facility. The number of helicopter mechanics assigned to the helicopter battalions, the corps area, and division area can be found in tables M-8 through M-9. Note from these tables that none of the helicopter maintenance facilities had their mechanics 100% utilized during any TP of the scenario.

2 Recovery - The AH64D and the RAH66 do not require assisted recovery. If one of these helicopters receives non-catastrophic damage, that helicopter is assumed to self-recover. Helicopter RTC will never be impeded by recovery assets.

3 Evacuation - The AH64D and the RAH66 do not require a HET for evacuation. Instead, a generic evacuation vehicle is used to evacuate AH64Ds and RAH66s. The availability of HETs does not hamper the process of helicopter evacuation.

4 Conclusion:

None of the three CSS assets (recovery, evacuation, and repair) restricted helicopter RTC during the scenario.

(g) Medical treatment.

1 Personnel can be in one of the following three categories: combat ready, medical treatment process, or KIA. When injured personnel arrive at a medical facility, they receive treatment immediately, have to wait for the next available medic, or have to be evacuated to a higher echelon because of the severity of the wound. After treatment, injured personnel are returned to their respective unit. Refer to

table M-10, at TP 5, the theater's Blue troop force was at 97%, its lowest availability during any TP of the scenario (the troop force availability at TP 5 was lower than the availability at TPs 2, 3, and 6 by .11, .08, and .17 percentage points respectively).

TP	Combat Ready	Being Treated	KIA	% AVAIL
0	14,403	0	0	100
1	14,000	315	87	98
2	13,874	375	154	97
3	13,777	357	269	97
4	13,794	304	305	98
5	13,551	405	446	97
6	13,390	390	623	97

Theater Personnel Profile

Table M-10

2 During the course of the scenario, the majority of personnel that are not combat ready are being treated or awaiting treatment at the corps area. When injured personnel have to be evacuated to corps, their severe injuries take approximately six days to treat; therefore, those persons will not return to duty for the remaining part of the scenario.

3 While the combined totals of the theater's Blue troop forces always remained above the 80% availability sufficiency criteria, three units (units B1210RE, B1230RE, and B1240RE) fell below this criterion for two or more consecutive TPs. These units are listed in table M-11 along with their troop combat availability percentage. The increase of combat intensity in the later part of the scenario and the treatment time of injured troops evacuated to the corps area are the two factors that contribute to the low troop availability at these units.

TP	1	2	3	4	5	6
B1210RE	96	93	99	59	59	100
B1230RE	95	91	45	45	44	44
B1240RE	74	61	100	100	100	100

Percentage of Personnel Available

Table M-11

4 Conclusion:

Medical repair teams organic to echelons lower than division did not constrain personnel RTC.

(2) Key Weapon Availability.

(a) Up to this point the analysis has addressed individual CSS support services (recovery, evacuation, repair, medical treatment) and their impact on RTC. With the exceptions noted, for the most part each of these support services was sufficient for the available workloads.

(b) The following section of the report, in effect, examines the cumulative effects of CSS services by looking at the availability of key weapons. Tables M-13 through M-22 provide unit level overviews for each key weapon system.

1 Each table (M-13 through M-22) contains the following information:

-Initial Strength (stgn) - weapon system density at the start of the scenario.

-End Strength (stgn) - weapon system density at the end of the scenario.

-Permanent Losses (K-kills) - catastrophic kills and abandonments.

-End % availability - weapon system availability at the end of the scenario. This availability calculation excludes permanent losses in conformance with the earlier described sufficiency criteria. Permanent losses are excluded because their occurrence is independent of how well (or poorly) CSS performs.

2 Two phenomena appearing in the following tables warrant discussion:

a A "dead unit" is indicated when the "end strength" and "availability" are zero. A "dead unit" occurs when significant unit resources are decimated and that unit can no longer effectively function. Its surviving resources, damaged and undamaged, are distributed to repair or other units requiring weapons, respectively. The row in each table for dead units is shaded.

b One would expect the "end strength" to always be smaller than initial strength if there were permanent losses. This is not always the case because of the need based reissue of repaired (and crewed) weapons. Depending on the current available strength of a weapon, reissues are distributed proportionally higher to those units with the greatest need (lowest current strength) and not to the unit which originally "owned" the weapon.

(c) Results:

1 All weapon systems meet the availability sufficiency criteria (80%) except for the following case:

- The ending availability of the M1A2s at the following units was below the 80 percent mark: B1110AR (53 percent), B1220MX (73 percent), and B1250AR (48 percent). Unit B1110AR had nine M1A2s in the process of being reissued at the conclusion of TP 6. When these systems reach their owning unit the availability will be approximately 84 percent. The main reason for unit B1220MX not maintaining a 80 percent availability strength was that three M1A2s were waiting for mechanics to become available at the supporting FSC. After these M1A2s are returned to duty, this unit's M1A2 availability will raise above the 80 percent mark. Unit B1250AR had a combination of the above mentioned situations. At the end of TP 6 there were six M1A2s waiting to be repaired at this unit's FSC and eight M1A2s being reissued to the battlefield. Even with the eight systems being reissued, B1250AR M1A2's would still be below the 80 percent mark.

- The ending availability of the M2A3/TOWs at the following units was below the 80 percent mark: B1110AR (48 percent) and B1250MX (75 percent). Unit B1110AR's FSC was reissuing two M2A3/TOWs at the end of TP 6. One more M2A3/TOW was waiting for a crew to become available. Even with the return of these three M2A3/TOWs, this system's availability will not reach the 80 percent mark. The FSC supporting unit B1250AR was in the process of reissuing three M2A3/TOWs at the end of the scenario. The addition of three M2A3/TOWs would push this unit's ending availability well above the 80 percent level.

- The ending availability of the FSV/45MMs at unit B1120AR was below the 80 percent mark (75 percent). One FSV/45MM was in the process of being repaired at this FSC. When this system is returned to duty, the availability of FSV/45MMs at this unit will be well above 90 percent.

2 The following table lists the only unit that was rendered combat ineffective ("dead") during the scenario, the time that the unit became ineffective, and the major weapon system(s) organic to that unit.

Ineffective "Dead" Unit	Time	Major Weapon Systems
B1220RE	12.0	FSV/45MM

Unit Rendered Combat Ineffective During the Scenario
Table M-12

Reference (b).1. of Section (2), Key Weapon Availability -- end % availability is the weapon system availability at the end of the scenario. This availability calculation excludes permanent losses in conformance with the earlier described sufficiency criteria. Permanent losses are excluded because their occurrence is independent of how well (or poorly) CSS performs.

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1001DC	9	7	1.6	94
B1002DC	9	7.1	1.6	97
B1003DC	9	8	0.1	90
B1110AR	30	14.5	2.7	53
B1120AR	30	24.7	2.2	89
B1130MX	14	11.4	1.3	90
B1140MX	14	12.8	0.1	92
B1210AR	30	27.5	0.1	92
B1220MX	14	9.6	0.7	73
B1230MX	14	12.9	0.1	93
B1250AR	30	13.4	1.8	48
Total Permanent Losses		12.3		

M1A2 Status
Table M-13

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1100AR	3	3.0	0.1	100
B1110AR	14	5.7	2.2	48
B1120AR	14	11.3	1.1	88
B1130MX	30	20.5	5.4	83
B1140MX	30	28.0	0.4	95
B1200MX	3	2.9	0.0	95
B1220MX	30	23.4	1.9	83
B1230MX	30	28.7	0.0	96
B1250AR	28	19.6	1.8	75
Total Permanent Losses		12.9		

M2A3/TOW Status
Table M-14

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1001DC	1	0.8	0.3	100
B1003DC	1	0.9	0	96
B1110AR	1	0.4	0.2	52
B1130MX	1	0.7	0.2	89
B1140MX	1	1	0	96
B1250AR	2	1.5	0.2	85
Total Permanent Losses			0.9	

M3A3/TOW Status

Table M-15

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1110AR	4	3.2	0.1	83
B1130MX	4	3.9	0.2	100
B1250AR	8	6.1	0.5	82
Total Permanent Losses			0.8	

BSFVE/STINGER Status

Table M-16

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1000LH	2	2.0	0.0	98
B1001DC	9	7.8	0.9	96
B1002DC	9	8.3	0.6	98
B1003DC	9	8.7	0.2	99
B1110AR	6	3.3	0.6	60
B1110RE	2	2.0	0.1	100
B1120AR	6	4.3	0.3	76
B1120RE	3	3.0	0.3	100
B1130MX	6	5.2	0.4	92
B1130RE	2	2.0	0.2	100
B1140MX	6	5.8	0.1	98
B1140RE	2	2.0	0.2	100
B1150RE	2	2.0	0.1	100
B1160RE	3	2.6	0.1	89
B1210AR	6	5.9	0.0	98
B1210RE	2	2.0	0.5	100
B1220MX	6	5.9	0.0	98
B1220RE	3	0.0	0.4	0
B1230MX	6	5.8	0.0	97
B1230RE	2	0.0	0.3	0
B1240RE	2	2.0	0.6	100
B1250AR	6	5.7	0.0	95
B1250RE	2	2.0	0.3	100
B1260RE	3	3.0	0.0	100
Total Permanent Losses			6.3	

FSV/45MM Status

Table M-17

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B000000	6	5.9	0	98
B1000DH	6	5.9	0	98
B1000LH	6	5.9	0	98
B1001DC	3	2.4	0.6	97
B1003DC	3	2.8	0.1	97
B1004M2	6	5.9	0	98
B1100AR	6	5.7	0.2	98
B1100H2	6	5.8	0	96
B1200H2	6	5.9	0	98
Total Permanent Losses			0.9	

AVENGER Status

Table M-18

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1001M2	3	2.8	0	94
B1002M2	3	1.6	1.2	85
B1003M2	3	1.7	1	87
B1004M2	3	1.6	1.1	83
B1005M2	3	1	1.5	71
B1006M2	3	1.6	1.1	85
B1007M2	3	2.8	0	94
B1008M2	3	2.6	0.2	92
B1009M2	3	2.4	0.4	92
Total Permanent Losses			6.5	

MLRSD Status

Table M-19

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1100H2	24	15.2	5.0	80
B1200H2	24	23.7	0.0	99
Total Permanent Losses			5.0	

AFAS-D Status

Table M-20

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1000DH	32	20.9	8.6	89
Total Permanent Losses			8.6	

AH64D Status

Table M-21

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1000LH	24	20.7	1.2	91
Total Permanent Losses			1.2	

RAH66 Status

Table M-22

(3) CSS Workloads. The following CSS workloads are provided to show the type and magnitude of workload serviced by each unit.

(a) Recovery and evacuation vehicle workload. The second and third columns in table M-23 indicate the number of vehicles that required assisted recovery from their owning unit. The fourth through seventh columns show the number of vehicles that required evacuation 'in' and 'out' of a higher echelon maintenance unit; also indicated is whether or not the vehicle required a HET for evacuation.

Maint Unit	Total # of assisted recoveries		# EVAC'D IN		# EVAC'D OUT	
	HMTWRECKER	M88	TOTAL	w/ HET	TOTAL	w/ HET
CSB(DS)	94.3	93.0	8.5	8.5	0.0	0.0
B10000H	0.4	12.4			1.5	1.5
B1000DH	0.3	0.0			0.0	0.0
B1000EN	0.1	0.0			0.0	0.0
B1000LH	0.3	0.0			0.0	0.0
B1000UH	0.3	0.2			0.0	0.0
B1100AR	10.2	30.4			4.1	4.1
B1100H2	0.0	2.1			1.0	0.4
B1110AR	0.6	23.1			23.5	15.2
B1120AR	7.4	16.0			0.0	0.0
B1130MX	0.4	15.3			3.5	3.3
B1140MX	0.6	3.2			0.0	0.0
B1200H2	0.0	3.6			0.0	0.0
B1200MX	1.9	6.1			2.9	2.9
B1210AR	0.2	2.1			0.0	0.0
B1220MX	0.2	9.6			0.0	0.0
B1230MX	0.2	2.9			0.0	0.0
B1250AR	0.3	22.5			1.4	1.4

Recovery and Evacuation Workload
Table M-23

(b) Medical team workload. Table M-24 shows the number of personnel that arrived at a medical facility during the scenario due to combat and non-combat (DNBI) actions. The last column displays the number of treatment man hours expended by all medical teams.

MEDICAL UNIT	CBT MEDICAL RECOVERED	DNBI MEDICAL RECOVERED	MMH EXPENDED	MEDICAL UNIT	CBT MEDICAL RECOVERED	DNBI MEDICAL RECOVERED	MMH EXPENDED
CSB(DS)	101.0	53.9	194.2	B1110AR	0.8	13.4	28.2
B100002	1.2	10.9	23.7	B1120AR	3.9	12.3	28.5
B10000H	0.3	20.7	42.8	B1130MX	1.6	14.9	32.2
B1000DH	0.0	8.4	16.7	B1140MX	1.5	15.0	30.7
B1000EN	0.0	3.4	6.8	B1200H2	0.0	11.2	22.0
B1000LH	0.0	10.0	19.7	B1200MX	2.2	33.4	67.6
B1000UH	0.3	10.5	24.3	B1210AR	0.1	10.7	21.0
B10DASB	0.0	9.5	17.0	B1220MX	0.5	15.3	31.1
B1100AR	1.2	20.1	41.0	B1230MX	0.4	15.3	30.5
B1100H2	1.2	11.1	24.1	B1250AR	6.1	17.7	39.2

Medical Unit Workload
Table M-24

(c) Maintenance team workload. Table M-25 shows the number of vehicles (both ground and air) that were recovered to a maintenance facility during the scenario. The last four columns display the number of maintenance man hours expended on ground and air vehicles and the estimated number of maintenance man hours required at TP 6 to repair all vehicles at the maintenance facilities.

MAINT. UNIT	# VEHICLES RECOVERED		GROUND VEHICLES		HELICOPTERS	
	CBT DAMAGE	RAM DAMAGE	MMH EXPENDED	MMH NEEDED	MMH EXPENDED	MMH NEEDED
CSB(DS)	175.1	198.5	810.4	625.7	46.0	2.0
B100002	4.0	14.4	20.5	0.3		
DASB	23.6	32.7	98.2	13.5	15.5	9.9
B1000DH	4.3	22.7	2.1	0.3	49.8	
B1000EN	0.0	4.6	1.7	0.1		
B1000LH	1.0	26.5	3.4	0.3	66.6	0.6
B1000UH	0.3	14.9	3.6	0.5	9.9	3.5
B10DASB	0.0	16.3	8.8	0.5		
B1100AR	29.7	41.3	203.4	29.8		
B1100H2	13.2	13.8	35.2	1.1		
B1110AR	60.9	18.3	147.6	2.8		
B1120AR	75.6	19.6	197.6	31.4		
B1130MX	62.0	20.9	192.7	4.7		
B1140MX	18.1	23.5	62.9	6.8		
B1200H2	0.0	16.0	13.8	2.0		
B1200MX	26.5	51.6	80.2	9.9		
B1210AR	0.4	18.5	31.5	7.2		
B1220MX	14.8	23.3	66.6	26.5		
B1230MX	8.0	24.0	36.1	15.6		
B1250AR	54.0	29.5	162.8	56.8		

Maintenance Unit Workload

Table M-25

(4) Observations.

- 1) Neither recovery operations nor evacuation is a constraint on weapon system RTC.
- 2) The automotive mechanics at the DSB constrained the above mentioned CSS vehicles from returning to duty. There was an insufficient number of automotive mechanics at the CSB(DS) to handle the workload produced by this scenario.
- 3) None of the three CSS assets (recovery, evacuation, and repair) restricted helicopter RTC during the scenario.
- 4) Medical repair teams organic to echelons lower than division did not constrain personnel RTC.

6. Supply Analysis.

- a. This analysis assesses the CSS system's capability to support combat and combat support units for the defined scenario. The CSS units must fill requests for replenishment stockages in a "timely fashion;" failure to do so can be attributed to lack of transporters, lack of stockages, long order-to-delivery times, or a combination of the three.

b. Analysis. This analysis is structured into two parts: supply class III and supply class V.

(1) Supply Class III.

(a) Requirement. For the scenario, the requirement for class III (petroleum) was found by summing the consumption (quantities "used" plus quantities "lost") of all maneuver units (CSS units were excluded from this computation) during each TP. Calculated in "gallons (gals)," the requirement for class III for the length of the scenario is presented in table L-1.

The consumption of supplies generates a requirement for stocks of supply types as well as transportation assets to deliver the replenishments to maneuver unit stockages. Consumption is translated into an order for materiel. Each order levies upon the CSS system a requirement for existing stocks and transportation assets. The authorized amount declines with time due to the attrition of weapon systems. Each weapon system has an authorized amount of specific supply types, and the authorized stockage is reduced as systems are killed. Table L-1 identifies the area of operation (AO) stockage levels and activities for class III: 1) amounts used; 2) amounts lost; and 3) amounts consumed (the requirement).

TP	USED GALS	LOST GALS	REQUIREMENT CONSUMED
0	0	0	0
1	23,526	4,032	27,558
2	20,478	1,766	22,244
3	13,826	780	14,606
4	49,951	54	50,005
5	18,137	824	18,961
6	12,040	136	12,176
TOTAL	137,958	7,592	145,550

Consumption of Class III, GALS

Table L-1

(b) Discussion. The resupply options for maneuver units are: 1) resupply is unnecessary (Balance on Hand \geq 75% of Authorized); 2) standard resupply (Balance on Hand \geq 50% & $<$ 75% of Authorized); or 3) emergency resupply (Balance on Hand $<$ 50% of Authorized); reference Appendix B for definitions of "standard" and "emergency" resupply. Table L-2 indicates that during no TP did any maneuver unit have a BOH so low as to warrant the use of either standard or emergency resupply.

RESUPPLY	TP						
	0	1	2	3	4	5	6
RESUPPLY UNNEC	56	56	54	53	49	48	47
STANDARD RESUPPLY	0	0	2	2	2	3	4
EMERGENCY RESUPPLY	0	0	0	0	0	0	0
ALL UNITS ¹	56	56	56	55	51	51	51

¹ COMBAT INEFFECTIVE (DEAD) UNITS ARE NOT INCLUDED.

Number of Maneuver Units Needing Resupply, Class III

Table L-2

For more detail on individual units requiring resupply see table L-3 below. These units wait 1 TP before their BOH returns to a level no longer requiring resupply of class III.

Unit	TP							#TPs
	0	1	2	3	4	5	6	
B1000DH			63	68		72	67	4
B1000LH			72		69			2
B1000UH				68	67	62	54	4
B1004EN							68	1
B1005EN							71	1
B1200H2					63	73		2
#Units	0	0	2	2	3	3	4	14

Percentage of Balance On-Hand (%) for Maneuver Units
Requiring Resupply, Class III
Table L-3

For example, at the end of TP 6, B1004EN had a class III BOH of 68%. This was the only TP in which B1004EN could have asked for resupply. During TP 6, B1004EN was one of four units capable of requesting resupply.

(c) Problems. Table L-3 shows BOH percentage for individual maneuver units requiring resupply. However, a review of individual orders revealed the following problems with the availability of transporters (reference table L-4).

TP	REQUESTING UNIT	SUPPLY UNIT	SUPPLY TYPE	AMOUNT REQUESTED EACHES	AMOUNT SHIPPED EACHES	AMOUNT SHORTED (%)	TRUCKS AVAIL	AVAIL STOCKS EACHES
1	B1000DH	B10DASB	POL-B	18,314.21	1,171.51	94	0.0	143,329
2	B1000DH	B10DASB	POL-B	19,870.5	1,163.01	94	0.0	143,329
3	B1000DH	B10DASB	POL-B	10,386.09	1,157.08	89	0.0	143,329
3	B1000UH	B10DASB	POL-B	17,462.96	1,172.23	93	0.0	143,329
3	B1000DH	B10DASB	POL-B	14,316.43	17.11	100	0.0	143,329
3	B1000UH	B10DASB	POL-B	19,223.58	0	100	0.0	143,329
3	B1000DH	B10DASB	POL-B	11,723.1	1,152.66	90	0.0	143,329
3	B1000UH	B10DASB	POL-B	19,434.71	0	100	0.0	143,329
4	B1000DH	B10DASB	POL-B	10,920.75	17.11	100	0.0	143,329
4	B1000UH	B10DASB	POL-B	17,776.52	1,167.75	93	0.0	143,329
4	B1000UH	B10DASB	POL-B	14,829.64	0	100	0.0	143,329
4	B1000UH	B10DASB	POL-B	4,852.92	0	100	0.0	143,329
4	B1200H2	B1200FS	POL-B	4,856.93	2,425.92	50	0.0	143,300
5	B1000DH	B10DASB	POL-B	12,600.54	1,164.87	91	0.0	136,074
5	B1200H2	B1200FS	POL-B	4,218.54	2,424.73	43	0.0	143,300
6	B1000DH	B10DASB	POL-B	9,678.97	1,172.32	88	0.0	134,911
6	B1000DH	B10DASB	POL-B	11,258.34	0	100	0.0	134,911
	TOTAL			221,724.7	14,206.3	94		

Problems Filling Maneuver Unit Orders, Class III
Table L-4

To quantify a measure of risk, the maximum consumption of class III by a unit for any TP is compared with the current BOH for each TP; if the value is less than one, the unit would exhaust its supplies prior to repeating the activities of this "maximum" TP. Where "at risk" is less than one TP of supply, class III was generally provided to maneuver units without placing them "at risk". No maneuver units were "at risk".

(d) Observation.

- 1) No maneuver unit required emergency replenishment of class III.
- 2) Problems filling maneuver unit orders for Class III were due to the nonavailability of trucks.
- 3) In general, Class III CSS support was adequate and all maneuver units were supported in a "timely fashion."

(2) Supply Class V.

(a) Requirement. For the scenario, the requirement for class V (ammunition) was found by summing the consumption (quantities "used" plus quantities "lost") of all maneuver units (CSS units were excluded from this computation) during each of the 4-hour TPs. Calculated in "short tons (stons)," the requirement for class V for the length of the scenario is presented in table L-5.

TP	USED STONS	LOST STONS	REQUIREMENT CONSUMED
0	0	0	0
1	1,306	69	1,375
2	363	33	395
3	208	12	220
4	132	0	132
5	27	7	34
6	0	1	1
TOTAL	2,035	122	2,157

Consumption of Class V, STONS

Table L-5

(b) Discussion.

1) This analysis focuses on fourteen munition types {155MM, ATACMS, MLRS, Hellfire, Longbow, Stinger, 120MM, 60MM, 25MM, Javelin, LAW, TOWII, NATCMS, and Other Naval Systems} using five indices {Amount Authorized, Amount On-Hand, Amount Used, Amount Lost, and Ratio of Amount On-Hand to Amount Authorized}. A list of all corps and division assets listing VIC unit name designators and their actual unit names is contained in Appendix A. A list of all supply analysis definitions is contained in Appendix B.

a) The fourteen aforementioned munition types were grouped into eight functional categories (Field Artillery, Aviation, Air Defense Artillery, Armor & Mechanized Infantry, Light Infantry, Anti-Armor, Anti-Tank and Naval Systems). Each of the functional categories was divided into subcategories displayed in table L-6:

Category	Member Munition Type
Field Artillery	155MM - {M107(CB), M116B1, M121A1, M449A1, M483A1, M549A1, M718+M741, M795, M825, M864, M864/AR, M864/GM, XM898, XM898/AR, XM898/GM, XM898_P3I, XM982, XM982/GM} ATACMS - {ATACMS_I, ATACMS_IA, ATACMS_II, ATACMS_IID} MLRS - {M26, XM85, ER-MLRS_I, MSTAR/BAT_P3I, MSTAR/SADARM_P1}
Aviation	HELLFIRE, LONGBOW
Air Defense Artillery (ADA)	STINGER
Armor & Mechanized Infantry	120MM - {120MM, PGMM, M929, M933}
Light Infantry	60MM - {M302A1, M720}
Anti-Armor	25MM - {25MM, 45MM}
Anti-Tank	JAVELIN, LAW, TOWII
Naval Systems	NATCMS - {NATACMS, NATACMS_I, NATCMS_IID} Other Naval Systems - {ERGM/AA, EX171}

Key Functional Categories

Table L-6

b) Table L-7 displays the key munition types with the five aforementioned indices for each key munition at the end of the scenario. **The scenario end states shown are reliable indicators of individual unit supply status over the course of the scenario:**

c) Table L-7 represents an aggregation by munition type for all units in the modeled force. However, supply performance at some individual units for specific munitions varied significantly from these general indicators.

- The first column, key munition type, lists each of the munition types included for analysis in this report.

- The second column, amount authorized indicates quantities at initial state (TP 0) of the scenario.

- The total amount used of a key munition type (column three) can exceed the endstate BOH because during a particular TP a unit can receive a key munition type.

- Munitions lost due to combat activity (column four) did not cause any significant inventory imbalances resulting in availability shortfalls.

- The fifth and sixth columns, amount authorized and balance on hand (BOH) respectively, indicate quantities at endstate (TP 6) of the scenario.

- The seventh column, percentage of balance on hand of amount authorized, indicates that at endstate (TP 6) of the scenario, the quantity of munitions available for mission support was large and more than sufficient to meet requirements. **The Balance on Hand was at least one hundred percent of authorized for each munition type except (155MM, ATACMS, MLRS, STINGER, 60MM, NATACMS, and Other Naval Systems).**

Key Munition Type	Initial State Amt Authorized (Rounds) @ TP0	Consumption		Endstate		
		Total Amount Used (Rounds)	Total Amount Lost (Rounds)	Amt Authorized (Rounds) @ TP6	BOH @ TP6 (Rounds)	Percentage BOH of Authorized
155MM	18,486	5,939	365	16,635	15,060	90.5%
ATACMS	188	167	0	181	55	30%
MLRS	4,798	1,962	105	3,038	2,823	93%

Key Munition Type	Initial State Amt Authorized (Rounds) @ TPO	Consumption		Endstate		
		Total Amount Used (Rounds)	Total Amount Lost (Rounds)	Amt Authorized (Rounds) @ TP6	BOH @ TP6 (Rounds)	Percentage BOH of Authorized
HELLFIRE	345	0	0	257	345	134%
LONGBOW	2,023	147	8	1,499	2,728	182%
STINGER	612	158	6	559	554	99%
120MM	21,776	1,161	305	17,030	21,365	125%
60MM	2,628	0	0	2,563	2,114	82%
25MM	297,234	144	36,706	245,219	263,743	108%
JAVELIN	377	9	23	322	345	107%
LAW	53	0	0	52	53	102%
TOWII	1,312	95	46	1,056	1,182	112%
NATACMS	156	155	0	156	124	79%
Other Naval Systems	12,000	988	0	12,000	11,632	97%

Key Munition Status
Table L-7

d) Table L-8 provides an overall summary of the additional supply indicators which helps assess the sufficiency of munition availability. Although the indicators are shown by munition type, the individual indicators represent the presence (Yes) or absence (No) of that indicator for some specific unit(s) in the force at the end of a specific TP. Table L-9 thru L-24 provide more detailed analyses of the aforementioned munition availability criteria.

Key Munition Type	BOH(>=75%)	Standard Replenishment BOH(50%-74%)	Emergency Replenishment BOH(1%-49%)	BOH(=0)
155MM	Yes	Yes	Yes	Yes
ATACMS	Yes	No	Yes	Yes
MLRS	Yes	Yes	Yes	Yes
HELLFIRE	Yes	No	No	No
LONGBOW	Yes	Yes	No	No
STINGER	Yes	Yes	No	No
120MM	Yes	No	No	No
60MM	Yes	Yes	No	No
25MM	Yes	No	No	No
JAVELIN	Yes	Yes	Yes	No
LAW	Yes	No	No	No
TOWII	Yes	Yes	No	No
NATACMS	Yes	Yes	Yes	No
Other Naval Systems	Yes	No	No	No

Balance on Hand Status
Table L-8

- Balance on Hand (>=75%) of Authorized: Initially all units start in this range since the amount authorized is equal to the balance on hand. BOHs which remain in this range maintain a sufficient quantity of authorized munitions and at no time throughout the scenario require supply replenishment.

- Balance on Hand (50%-74%) of Authorized: This column indicates whether or not the BOH by munition type at any unit fell to the indicated percentage range of the authorized amount. BOH in this range triggers "standard supply replenishment" requests.

-- For six of the munition types (ATACMS, HELLFIRE, 120MM, 25MM, LAW, and Other Naval Systems) no standard supply replenishment was required at any time during the scenario. No HELLFIRE, 60MM or LAW munition type was expended during this scenario. Also, no ATACMS, HELLFIRE, 60MM, LAW, NATACMS, or Other Naval Systems munition type was lost due to attrition of systems.

-- The other eight munition types (155MM, MLRS, LONGBOW, STINGER, 60MM, JAVELIN, TOWII and NATACMS) triggered standard resupply orders at some specific unit. Tables L-9 through L-16 identify the unit, the time period, and the sub-munition(s) which triggered a standard resupply order.

Unit Name	BOH(50% / 74%)	Time Period(TP)	Sub-munition
1/511 FA Bn, Div Sup Arty	58%	TP 1	M864
	57%	TP 2	XM898_P3I
	60%	TP 3	XM898_P3I
	54%	TP 4	M107/CB
	55%	TP 4	XM898_P3I
	60%	TP 5	XM898_P3I
	73%	TP 6	M1-7/CB
	61%	TP 6	XM898_P3I
1/2 Div Sup Arty	61%	TP 1	M864
	69%	TP 2 & 3	M864
	56%	TP 3	XM982
	70%	TP 4	M864
	57%	TP 4	XM982

155MM Standard Replenishment
Table L-9

Unit Name	BOH(50% / 74%)	Time Period(TP)	Sub-munition
3/A/1-511 Field Artillery	59%	TP 2	XM85
3/B/1-511 Field Artillery	75%	TP 2	XM85
	61%	TP 3	MSTAR/SADARM
3/C/1-511 Field Artillery	54%	TP 4	XM85
	53%	TP 5 & 6	XM85

MLRS Standard Replenishment
Table L-10

Unit Name	BOH(50% / 74%)	Time Period(TP)	Sub-munition
Div Cav FARP	54%	TP 2	LONGBOW

LONGBOW Standard Replenishment
Table L-11

Unit Name	BOH(50% / 74%)	Time Period(TP)	Sub-munition
1/511 FA Bn, Div Sup Arty	72%	TP 2	STINGER
1/2 Div Sup Arty	74%	TP 1	STINGER

STINGER Standard Replenishment
Table L-12

Unit Name	BOH(50% / 74%)	Time Period(TP)	Sub-munition
3-49 INF Bn	53%	TP 0	60MM
	74%	TP 1	60MM

60MM Standard Replenishment
Table L-13

Unit Name	BOH (50% - 74%)	Time Period (TP)	Sub-munition
4/1 Bde Recon Team	50% 54%	TP 1, 3, 4 TP 5 & 6	JAVELIN JAVELIN
5/1 Bde Recon Team	73% 71%	TP 1 TP 3 & 4	JAVELIN JAVELIN
1/2 Bde Recon Team	56%	TP 3	JAVELIN

JAVELIN Standard Replenishment
Table-14

Unit Name	BOH (50% - 74%)	Time Period (TP)	Sub-munition
Div Cav A Trp	62%	TP 3	TOWII

TOWII Standard Replenishment
Table L-15

Unit Name	BOH (50% - 74%)	Time Period (TP)	Sub-munition
Ship 5	50%	TP 3 - 6 TP 3 - 6	NATACMS NATACMS_IIA
Ship 6	50%	TP 3 - 6 TP 3 - 6	NATACMS NATACMS_IIA

NATACMS Standard Replenishment
Table L-16

- Balance on Hand (18-49%) of Authorized: This column indicates whether or not the BOH by munition type at any unit fell to the indicated percentage range of the authorized amount. BOH in this range triggers "emergency supply replenishment" requests. Five of the munition types (155MM, ATACMS, MLRS, JAVELIN, and NATACMS) required emergency resupply. Tables L-17 through L-21 depict specific unit, time period, and sub-munition type which generate an emergency resupply request.

Unit Name	BOH (18-49%)	Time Period (TP)	Sub-munition
1/511 FA Bn, Div Sup Arty	39% 24% 42% 50% 48%	TP 1 TP 2 TP 2 TP 3 TP 4 & 5	XM982 M864 XM982 M864 M864
1/2 Div Sup Arty	5% 35%	TP 1 TP 2	XM982 XM982

155MM Emergency Replenishment
Table L-17

Unit Name	BOH (18-49%)	Time Period (TP)	Sub-munition
1/A/1-511 Field Artillery	49% 26% 25% 15% 34% 19% 13%	TP 1 TP 1 TP 2 TP 2 TP 3 TP 4 TP 5 & 6	ATACMS_I ATACMS_II ATACMS_I ATACMS_II ATACMS_I ATACMS_I ATACMS_I

ATACMS Emergency Replenishment
Table L-18

Unit Name	BOH(1%-49%)	Time Period(TP)	Sub-munition
2/A/1-511 Field Artillery	42%	TP 1	MSTAR/BAT_P3I
1/B/1-511 Field Artillery	24%	TP 1	ER-MLRS/I
	34%	TP 1	XM85
3/B/1-511 Field Artillery	4%	TP 3 - 6	XM85
	42%	TP 4	MSTAR/SADARM
	38%	TP 5	MSTAR/SADARM
	35%	TP 6	MSTAR/SADARM
1/C/1-511 Field Artillery	41%	TP 3	ER-MLRS/I

MLRS Emergency Replenishment
Table L-19

Unit Name	BOH(1%-49%)	Time Period(TP)	Sub-munition
1/1 Bde Recon Team	47%	TP 5 & 6	JAVELIN
4/1 Bde Recon Team	47%	TP 2	JAVELIN
1/2 Bde Recon Team	22%	TP 4 & 5	JAVELIN

JAVELIN Emergency Replenishment
Table L-20

Unit Name	BOH(1%-49%)	Time Period(TP)	Sub-munition
Ship 4	33%	TP 1 - 6	NATACMS_II/A

NATACMS Emergency Replenishment
Table L-21

- Zero Balance on Hand: This column indicates whether or not the BOH by munition type at any unit fell to zero. Three of the munition types (155MM, ATACMS, and MLRS) experience a zero balance on hand. Tables L-22 through L-24 depict specific unit, time period, and sub-munition type which experience a zero balance on hand.

Unit Name	BOH(=0)	Time Period(TP)	Sub-munition
1/511 FA Bn, Div Sup Arty	0%	TP 5 & 6	M107/CB

155MM Zero Balance
Table L-22

Unit Name	BOH(=0)	Time Period(TP)	Sub-munition
1/A/1-511 Field Artillery	0%	TP 3 - 6	ATACMS_II
	0%	TP 2 - 6	ATACMS_IIA

ATACMS Zero Balance
Table L-23

Unit Name	BOH(=0)	Time Period(TP)	Sub-munition
2/A/1-511 Field Artillery	0%	TP 2 - 6	MSTAR/BAT_P3I
3/A/1-511 Field Artillery	0%	TP 1 - 6	ER-MLRS/I
	0%	TP 3 - 6	XM85
1/B/1-511 Field Artillery	0%	TP 1 - 6	MSTAR/BAT_P3I
	0%	TP 1 - 6	MSTAR/SADARM_PI
	0%	TP 2 - 6	ER-MLRS/I
	0%	TP 2 - 6	XM85
2/B/1-511 Field Artillery	0%	TP 1 - 6	ER-MLRS/I
	0%	TP 1 - 6	XM85
3/B/1-511 Field Artillery	0%	TP 1 - 6	MSTAR/BAT_P3I
	0%	TP 3 - 6	ER-MLRS/I
1/C/1-511 Field Artillery	0%	TP 3 - 6	ER-MLRS/I
2/C/1-511 Field Artillery	0%	TP 1 - 6	ER-MLRS/I
3/C/1-511 Field Artillery	0%	TP 1 - 6	ER-MLRS/I

MLRS Zero Balance
Table L-24

(c) Problems. Of the 423 stons ordered, via standard resupply, 210 stons were shipped (approximately 49.6 percent). Problems in unfilled orders are associated with unavailable transporters or replenishments (reference table L-25).

TP	REQUESTING UNIT	SUPPLY UNIT	SUPPLY TYPE	AMOUNT REQUESTED (Rounds)	AMOUNT SHIPPED (Rounds)	AMOUNT SHORTED (%)	TRUCKS AVAIL	AVAIL STOCKS (Rounds)
1	B1100H2	B001ASP	XM982	223.18	44.23	80	3.9	0
1	B1240IN	B124ISC	M720	949.6	438	54	9.8	0
1	B1000DH	B001CSA	LONGBOW	553.7	501.61	9	0.0	4,813
1	B1000LH	B10DASB	B20MM	42,088.91	4,800	89	17.9	0
1	B1000LH	B001ASP	B20MM	42,088.91	19,200	54	17.9	0
1	B1000LH	B001CSA	B20MM	42,088.91	18,088.91	57	0.0	134,400
1	B1200H2	B002ASP	M549A1	134.71	14.58	89	3.1	0
1	B1100H2	B001ASP	M549A1	138.17	21.07	85	0.0	160
1	B1100H2	B001ASP	M864	291.44	160	45	3.9	0
2	B1200H2	B002ASP	M864	372.07	160	57	3.8	0
2	B1100H2	B001ASP	XM898_P3I	700.79	80	89	3.6	0
2	B1100H2	B001ASP	XM982	188.76	43.61	77	3.6	0
4	B1100H2	B001ASP	XM898_P3I	698.94	76.92	89	3.5	0
4	B1200H2	B002ASP	M864	219.47	154.8	29	2.8	0
4	B1200H2	B002ASP	XM982	375.06	236.08	37	2.8	0
TOTAL				131,112.6	44,019.8	66		

Problems Filling Maneuver Unit Orders, Class V
Table L-25

- The problems of unfilled orders have rippled into maneuver units. In the table below, supply type-maneuver unit combinations that have a zero BOH are presented. The table has been coded: 0 - time and distance problems; 1 - unsupported materiel; 2 - insufficient replenishment stockages; and 3 - unavailable transporters. Generally, once a unit experienced a zero BOH, the zero BOH continued to the end of the scenario.

- From table L-26, zero BOH are attributed to shortages of transporters, shortages of replenishments, and large time-distances between maneuver units and their supporting CSS unit. The reader is cautioned regarding the "0"; some maneuver units consume everything on-hand, and cannot be provided a supply type fast enough regardless of the speed of the CSS system.

SUPPLY TYPE	MANEUVER UNIT	TP							# TPS
		0	1	2	3	4	5	6	
ATACMS_II	B1001M2				1	1	1	1	4
ATACMS_IIA	B1001M2			1	1	1	1	1	5
ER-MLRS/I	B1003M2		0	0	0	0	0	0	6
ER-MLRS/I	B1004M2			0	0	0	0	0	5
ER-MLRS/I	B1005M2		0	0	0	0	0	0	6
ER-MLRS/I	B1006M2				0	0	0	0	3
ER-MLRS/I	B1007M2				0	0	0	0	3
ER-MLRS/I	B1008M2		0	0	0	0	0	0	6
ER-MLRS/I	B1009M2		0	0	0	0	0	0	6
M107/CB	B1100H2					0	0	0	2
MSTAR/BAT_P3I	B1002M2			0	0	0	0	0	5
MSTAR/BAT_P3I	B1004M2		0	0	0	0	0	0	6
MSTAR/BAT_P3I	B1006M2		0	0	0	0	0	0	6
MSTAR/SADARM_PI	B1004M2		0	0	0	0	0	0	6
XM85	B1003M2			0	0	0	0	0	4
XM85	B1004M2			0	0	0	0	0	5
XM85	B1005M2		0	0	0	0	0	0	6

Causes for Zero BOH

Table L-26

To quantify a measure of risk, the maximum consumption of class V by a unit for any TP is compared with the current BOH for each TP; if the value is less than one, the unit would exhaust its supplies prior to repeating the activities of this "maximum" TP. Where "at risk" is less than one TP of supply, class V was generally provided to maneuver units without placing them "at risk." Eighteen maneuver units were "at risk." See Table L-27.

MANEUVER UNIT	TP							# of TPs
	0	1	2	3	4	5	6	
B1001DC		2	1	1				3
B1001M2		2	3	3	3	3	3	6
B1002M2		1	1	1	1	1	1	6
B1003M2		1	2	2	2	2	2	6
B1004M2		4	4	4	4	4	4	6
B1005M2		2	2	2	2	2	2	6
B1006M2		1	3	4	4	4	4	6
B1007M2					1	1	1	3
B1008M2		1	1	1	1	1	1	6
B1009M2		1	1	1	1	1	1	6
B1100H2	1	3	3	3	4	4	4	7
B1140RE		1	1	1	1	1	1	6
B1200H2	1	2	2	2	2	2	2	7
B1210RE				1	1	1	1	4
B1230RE				1	1	1	1	4
B1240RE					1	1	1	3
B1250AR	1	1	1	1				4
B5004SP		1	1	1	1	1	1	6

"At Risk" Units, Class V Risk

Table L-27

(d) Observations.

- 1) The primary causes for problems filling Class V CSS resupply requests are time and distance problems, as well as, insufficient replenishment stockages.
- 2) The 1/A/1-511 Field Artillery used its entire supply of ATACMS_IIA (TP 2) & ATACMS_II (TP 3) respectively.
- 3) The 1/B/1-511 Field Artillery used its supply of all MLRS sub-munitions types by TP 2. Also there was a major shortage of MLRS submunition type ER-MIRS/I for all field artillery units within the modeled force.
- 4) Eighteen maneuver units were "at risk".

APPENDIX A

DDA VIC Name to Unit Name Cross Reference

VIC Name	Unit Name
B0MAINT	EAD maintenance
B000000	Div HQ
B001CSA	csb fwd/fuel
B001ASP	AMMO
B002ASP	AMMO
B003ASP	AMMO
B004ASP	AMMO
B001POL	FUEL
B001CSB	CSB FWD/FUEL
B001SUP	
B5001SP	Ship 1
B5002SP	Ship 2
B5003SP	Ship 3
B5004SP	Ship 4
B5005SP	Ship 5
B5006SP	Ship 6
B1100AR	1st Bde
B1110AR	1-23 AR Bn
B111ASC	Mech Support Company
B1120AR	2-23 AR Bn
B112ASC	Armor Support Company
B1130MX	2-46 MX Bn
B113MSC	Mech Support Company
B1140MX	4-46 MX Bn
B114MSC	Mech Support Company
B1100H2	1/511 FA Bn, DS Arty
B1100FS	1/1 FSB
B1110RE	1/1 Bde Recon Team
B1120RE	2/1 Bde Recon Team
B1130RE	3/1 Bde Recon Team
B1140RE	4/1 Bde Recon Team
B1150RE	5/1 Bde Recon Team
B1160RE	6/1 Bde Recon Team
B1001EN	A/3-29 Engineer Co
B1002EN	B/3-29 Engineer Co
B1003EN	C/3-29 Engineer Co
B1200MX	2d Bde
B1210AR	3-23d AR Bn(-)
B121ASC	Armor Support Company
B1220MX	1-46 MX Bn
B122MSC	Mech Support Company
B1230MX	3-46 MX Bn
B123MSC	Mech Support Company
B1240IN	3-49 INF Bn
B124ISC	Infantry Support Company
B1250AR	4-23 AR TF
B1251AR	A/4-23 AR Bn

VIC Name	Unit Name
B1252AR	B/4-23 AR Bn
B1253MX	C/4-23 MX Bn
B1254MX	B/3-23 MX
B1004EN	D/3-29 Engineer Group
B125ASC	Armor Support Company
B1005EN	E/3-29 Eng Bn(-)
B1200H2	1/2 DS Arty
B1200FS	1/2 FSB
B1210RE	1/2 Bde Recon Team
B1220RE	2/2 Bde Recon Team
B1230RE	3/2 Bde Recon Team
B1240RE	4/2 Bde Recon Team
B1250RE	5/2 Bde Recon Team
B1260RE	6/2 Bde Recon Team
B10000H	102 Avn Bde
B1000DH	AH-64D Attack Bn
B1000UH	GS Avn Bn Bn
BNAVYCH	Navy CH-53 Squadron
B1001DC	Div Cav Trp
B1002DC	Div Cav Trp
B1003DC	Div Cav Trp
B1000LH	Div Cav FARP
B1006EN	F/3-29 En
B10DASB	Div Avn Support Bn
B100002	DIVARTY HQ
B1001M2	1/A/1-511 FA
B1002M2	2/A/1-511 FA
B1003M2	3/A/1-511 FA
B1004M2	1/B/1-511 FA
B1005M2	2/B/1-511 FA
B1006M2	3/B/1-511 FA
B1007M2	1/C/1-511 FA
B1008M2	2/C/1-511 FA
B1009M2	3/C/1-511 FA
B1000EN	3-29th Engineer Group
B1000DS	Division Support Bn (less maint to B000000)

APPENDIX B

DEFINITIONS

Specific supply analysis definitions are listed below:

- (1) Amount Authorized of this supply type: Amount of this supply type that this unit is authorized at the end of the TP, this number is calculated by multiplying the number of available systems that use this supply type by the amount authorized per system. This number can change from one TP to another due to weapon losses.
- (2) Balance on-Hand of this supply type: Amount of this supply type that this unit has on hand at the end of the TP.
- (3) Amount Used during this TP: Amount of this supply type that this unit used during this TP.
- (4) Amount Lost during this TP: Amount of this supply type that this unit lost due to attrition of systems (when a system is damaged in combat a percentage (50%) of its on-board supplies are lost).
- (5) Ratio of Balance on-Hand to Amount Authorized: A percent value used to indicate overall assessment of a munition; when this percent value is low, a greater risk is indicated as to possibility of exhausting all supplies.
- (6) Total Amount Authorized during this TP: The sum of each amount authorized of each supply type at the end of the TP. The stockages are redistributed, consumed, or lost as the scenario proceeds. As units are engaged and attrited, the amount-authorized is reconciled with the number of surviving weapon systems.
- (7) Total Amount on-Hand during this TP: The sum of the amount of each supply type that the units actually have in stock at the end of the TP. This amount is reduced by consumption, attrition, and other activities that may reduce the stockage of a supply type.
- (8) Total Amount Used during this TP: The sum of the amount of each supply type consumed as a result of movement and combat at the end of the TP.
- (9) Total Amount Lost during this TP: The sum of the amount of each supply type lost due to attrition of systems at the end of the TP (when a system is damaged in combat, a percentage of its on-board supplies are lost).
- (10) Total Amount on-Order during this TP: The sum of the amounts of each supply ordered by each unit during a period. As materiel is consumed, units initiate orders based on a re-order threshold to restock its supplies. If an order cannot be shipped for reasons of shortages of stocks or movers, a unit will re-order the replenishments during the next period.
- (11) Timely fashion: The manner in which a unit is supported when a negative consequence did not result. When a maneuver unit calls for replenishment of supplies, the support of the maneuver unit shall be said to be in a "timely fashion," if the maneuver unit did not suffer for lack of supplies. For class III, a unit suffers when it is forced to stop for lack of class III. For class V, a unit suffers a negative consequence when it exhausts a class V supply type.
- (12) Risk: The proportion of TPs that each supply type for each unit can be expected to last given the greatest consumption for the scenario. The higher the measure, the greater the quantity of stockage, hence the lower the likelihood of not being able to repeat the highest consumption of a TP.

(13) Standard Resupply: Maneuver units will generate an order for a supply type when, per the resupply schedule, the on-hand plus on-order quantity is less than 75 percent of the authorized quantity. The magnitude of the order is the amount of each supply type to bring the on-hand plus on-order quantity up to the authorized quantity. Routinely, the order is for 25% of authorized. When the shipment arrives, the on-hand balance will increase, and the maneuver unit will issue an order when the on-hand quantity again falls below the 75% authorized. Exceptions to this resupply process occur when, for lack of trucks or stocks, an order cannot be filled or shipped. When the order (or portion of same) cannot be shipped in the period it was requested, the unfilled portion is lost - there are no backorders or due-outs. The maneuver unit will reassess its needs during the next period. Standard resupply can be divided into two types: supply point distribution (SPD) and unit distribution (UD). A unit that uses SPD provides its own organic transporters to convey replenishments between the supply unit(s) and itself; a unit using UD requires the supply unit to provide both replenishments and transporters.

(14) Emergency Resupply: Maneuver units will generate an "emergency" order for a supply type when, per the resupply schedule, the on-hand plus on-order quantity is less than 50 percent of the authorized quantity. The magnitude of the order is the amount of each supply type to bring the on-hand quantity up to 50% of the authorized quantity. When the shipment arrives, the on-hand balance will increase. This is "emergency resupply." Emergency resupply is subject to a number of factors: (1) the availability of replenishment stockages; (2) the availability of helicopter support to provide airlift between the supporting CSS unit(s) and the requesting maneuver unit; and (3) the hostile environment surrounding the maneuver unit. If the scenario is short-lived or has intensive combat, the last factor can be the most limiting. Helicopters will not provide lift to maneuver units that are under assault. If any one of the factors prohibits emergency resupply, the "emergency" request for replenishments will be routed for "standard" resupply. When the order (or portion of same) cannot be shipped in the time period it was requested, the unfilled portion is lost - there are no backorders or due-outs - the unit must wait for the next period per the resupply schedule to assess its stockage position and re-order.

APPENDIX C

FIGURES AND TABLES

TP	USED GALS	LOST GALS	REQUIREMENT CONSUMED	AMOUNT RECEIVED BY AIR	AMOUNT RECEIVED BY TRUCK	AMOUNT REQUESTED	AMOUNT SHIPPED	% of ORDERED
0	0	0	0	0	0	0	0	---
1	23,526	4,032	27,558	0	10,199	18,314	1,172	6
2	20,478	1,766	22,244	0	7,442	27,125	8,418	31
3	13,826	780	14,606	0	6,075	92,547	3,499	4
4	49,951	54	50,005	0	14,462	53,237	3,611	7
5	18,137	825	18,961	0	7,783	16,819	3,590	21
6	12,040	136	12,176	0	10,175	25,573	5,808	23
TOTAL	137,958	7,592	145,649	0	56,135	233,615	26,096	11

Consumption of Class III, Gallons

Table C-1

TP	USED STONS	LOST STONS	REQUIREMENT CONSUMED	AMOUNT RECEIVED BY AIR	AMOUNT RECEIVED BY TRUCK	AMOUNT REQUESTED	AMOUNT SHIPPED	% of ORDERED
0	0	0	0	0	0	0	0	---
1	1,306	69	1,375	37	367	213	131	62
2	363	33	395	0	36	94	22	23
3	208	12	220	26	33	28	28	100
4	132	0	132	0	0	87	28	32
5	27	7	34	0	27	0	0	---
6	0	1	1	12	0	0	0	---
TOTAL	2,035	122	2,157	76	463	423	210	90

Consumption of Class V, STONS

Table C-2

CLASS V, TRUCKLOADS BY TP										
TP	7.62MM	B20MM	LONGBOW	M549A1	M720	M795	M864	M929	M933	POLE-B
0										
1		4.38	24.67	0.49	0.14		0.45	0.12	0.33	0.98
2		4.38	24.67	0.49	0.14		0.9	0.12	0.33	4.85
3	0.01	4.38	24.67	0.49	0.14	0.99	0.9	0.12	0.33	1.43
4	0.48	4.38	24.67	0.49	0.14	0.99	1.34	0.12	0.33	9.71
5	0.48	4.38	24.67	0.49	0.14	0.99	1.34	0.12	0.33	11.65
6	0.48	4.38	24.67	0.49	0.14	0.99	1.34	0.12	0.33	14.48

CLASS V, PERCENTAGE BY TP										
TP	7.62MM	B20MM	LONGBOW	M549A1	M720	M795	M864	M929	M933	POLE-B
0										
1	0	2.64	14.86	0.3	0.08	0	0.27	0.07	0.2	0.59
2	0	2.27	12.81	0.25	0.07	0	0.47	0.06	0.17	2.52
3	0	2.03	11.43	0.23	0.06	0.46	0.42	0.06	0.15	3.59
4	0.2	1.87	10.51	0.21	0.06	0.42	0.57	0.05	0.14	4.14
5	0.2	1.79	10.06	0.2	0.06	0.4	0.55	0.05	0.13	4.75
6	0.19	1.69	9.51	0.19	0.05	0.38	0.52	0.05	0.13	5.58

Truckloads On-Road, CSS-to-Maneuver Units
Table C-3

Unit Name	Amount Shipped	# of Deliveries	Minimum Time to Deliver	Avg Time to Deliver	Maximum Time to Deliver
B10DASB	15,438.23	14	1.93	2.32	4.03
B1100FS	2,426.04	2	0.82	1.19	1.55
B1200FS	4,850.65	2	3.18	3.47	3.75

Unit Name	Amount Shipped	# of Non-Deliveries	Minimum Time to Deliver	Avg Time to Deliver	Maximum Time to Deliver
B10DASB	1,172.32	2	6.75	7.25	7.75
B1200FS	2,209.2	2	8	8	8

Order to Deliver, Class III
Table C-4

Unit Name	Amount Shipped	# of Deliveries	Minimum Time to Deliver	Avg Time to Deliver	Maximum Time to Deliver
B001ASP	20,398.38	17	0.56	0.96	1.65
B001CSA	18,755.08	3	13.44	15.34	15.82
B002ASP	833.98	6	2.98	3.14	3.44
B10DASB	43,438.19	6	1.99	3.39	4.57
B1100FS	27	2	0.5	0.5	0.5
B111ASC	7.21	1	0.71	0.71	0.71
B112ASC	3,250.82	1	0.93	0.93	0.93
B113MSC	2,052.08	3	0.66	0.79	0.93
B124ISC	438	1	0.79	0.79	0.79

Order to Deliver, Class V
Table C-5

CLASS III (SDID-O), AMOUNT ON-HAND BY HOUR							
	0	1	2	3	4	5	6
B000000	23,670.9	23,235.7	22,772.3	22,299.4	21,747.8	21,218.7	20,688.4
B0MAINT	19,337.4	18,929.1	18,496.7	18,058.7	17,551	17,070	16,591.6
B100002	1,925.7	1,896.5	1,865.4	1,833.4	1,796.1	1,760.1	1,724.1
B10000H	67,282.9	67,130	66,966.7	66,800.3	66,606.2	66,418.9	66,230.9
B1000DH	42,438.9	34,292.6	24,487.7	25,622.8	29,043	27,432.2	26,067.8
B1000EN	11,387.6	11,321.8	11,251.5	11,179.8	11,095.9	11,015.8	10,935.4
B1000LH	26,058.2	22,256.3	18,674.8	24,475.2	22,430.1	20,878.8	19,263.5
B1000UH	62,935.6	54,689.3	48,446.8	43,566.3	41,606.7	37,950.7	32,975.4
B1001DC	7,897.8	6,436.3	6,417.6	6,395.7	6,367.7	6,340	6,312.1
B1001EN	4,716.7	4,431	4,127.4	3,822.1	3,498.1	3,271.2	3,050.4
B1001M2	4,114	4,061.5	4,005.6	3,948.5	3,881.9	3,818.3	3,754.8
B1002DC	7,652.8	6,197.9	6,173.8	6,148.1	6,117.3	6,087.5	6,057.7
B1002EN	4,716.7	4,417.6	4,121.8	3,823.2	3,478.2	3,228.9	2,999.7
B1002M2	4,114	3,968	3,935.4	3,899.6	3,855.3	3,810.9	3,765.5
B1003DC	7,897.8	6,177.6	6,149.9	6,121.3	6,087.8	6,055.6	6,023.6
B1003EN	4,716.7	4,425	4,127.8	3,822.5	3,471.1	3,127.8	4,149.8
B1003M2	4,114	3,974.8	3,938.7	3,899.5	3,851.8	3,804.5	3,756.2
B1004EN	4,716.7	4,425	4,121.5	3,815.9	3,464.3	3,133.6	2,799.1
B1004M2	4,603.1	4,543.6	4,392.6	4,340.8	4,286.5	4,232.7	4,177.9
B1005EN	4,716.7	4,425	4,121.5	3,815.9	3,467.3	3,132.5	2,799.5
B1005M2	4,456.1	4,338.9	4,212.1	4,146.6	4,106.8	4,065.8	4,023.3
B1006EN	4,716.7	4,430.1	4,129.4	3,830.3	3,488.7	3,154	3,875.4
B1006M2	4,114	3,965.5	3,932.1	3,895.4	3,850.3	3,805.2	3,759.1
B1007M2	4,114	4,061.5	4,005.6	3,948.5	3,881.9	3,818.3	3,754.8
B1008M2	4,114	4,044.8	3,992.6	3,936.5	3,874.2	3,814.4	3,754.3
B1009M2	4,114	4,027.1	3,978.9	3,928.7	3,869.5	3,812.3	3,754.7
B1100AB	6,149.5	6,006.7	5,901.1	5,792.1	5,661.8	5,535.4	5,408.7
B1100H2	16,680.6	16,302.6	15,615.2	15,189.1	14,341.8	14,049.7	13,778.9
B1110AR	25,498.6	24,470.3	24,126.1	23,948.5	23,171.4	22,649.1	22,140.8
B1110RE	392	379.7	379.2	378.4	377.4	376	375.1
B1120AR	24,641.1	24,334.4	23,903.4	23,715.7	23,050.4	22,108.1	21,212.9
B1120RE	588	561	559.8	557.7	555.6	554.3	553.1
B1130MX	20,736.8	19,868.6	19,505.4	19,226.8	18,998.5	18,879.4	18,757.3
B1130RE	392	376	375.2	373.9	372.9	372	371.1
B1140MX	20,050.8	19,928.5	19,770.1	19,555.9	18,500.6	18,360.5	18,218.4
B1140RE	392	373	372.3	371.1	370.1	368.3	367.5
B1150RE	392	376.9	376.3	375.4	374.2	372.8	371.9
B1160RE	588	581.6	577.3	574.8	571.2	565.8	561.9
B1200H2	16,680.6	16,336.8	13,217.6	12,845.6	10,164.9	11,815.4	13,853.5
B1200MX	6,002.5	5,902	5,795	5,685.5	5,558.3	5,436.5	5,314.5
B1210AR	21,743.3	21,651.7	21,554.5	21,455.4	18,248.5	16,711.3	16,600.9
B1210RE	392	381.2	371.2	352.3	341.9	341.9	341.4
B1220MX	19,879.3	19,757.8	19,629	19,497.4	17,422.4	15,833.4	15,696.9
B1220RE	588	578.5	546.2				
B1230MX	19,879.3	19,757.8	19,629	19,497.4	17,332.9	15,903.3	15,759.3
B1230RE	392	388.4	368.8	362.9	362.9	362.9	362.9
B1240IN	2,695	2,670	2,643.3	2,616	2,592.6	2,561.7	2,533.2
B1240RE	392	364	361.2	339.4	333.9	333.5	332.8
B1250AR	6,599.3	6,525.7	5,674.5	5,595	24,899.2	22,635.1	22,473.6
B1250RE	392	387.3	366	361.9	361	360	359
B1251AR	8,748.5	8,724.7	8,748.2	8,748.1			
B1252AR	8,189.9	8,189.6	8,189.6	8,189.5			
B1253MX	2,897.9	2,896.8	2,896.8	2,896.6			
B1254MX	2,897.9	2,897.2	2,897.4	2,897			
B1260RE	588	583.8	581.7	579.1	576.8	575.5	574
BNAVYCH	18,169.2	18,169.2	18,169.2	18,169.2	18,169.2	18,169.2	18,169.2